REQUEST FOR REDESIGNATION AND MAINTENANCE PLAN UNDER THE ANNUAL NATIONAL AMBIENT AIR QUALITY STANDARD FOR FINE PARTICLES

Southwestern Indiana Area

Prepared By:
The Indiana Department of Environmental Management

February 2008

PRE-HEARING DRAFT

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TABLE OF CONTENTS (page numbers subject to change)

FIGURES

TABLES

GRAPHS

APPENDICES

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Pre-Hearing DRAFT
INTERNAL AND DELIBERATIVE PURPOSES ONLY

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SOUTHWESTERN INDIANA AREA

1.0 INTRODUCTION

This document is intended to support Indiana's request that Dubois, Vanderburgh and Warrick Counties; Montgomery Township in Gibson County, Ohio Township in Spencer County, and Washington Township in Pike County (herein referred to as the "Southwestern Indiana Area"), be redesignated from nonattainment to attainment of the annual standard for fine particles. The Southwestern Indiana Area has recorded three (3) years of complete, quality assured ambient air quality monitoring data for the years 2004 through 2006 demonstrating attainment with the annual standard for fine particles, and is thereby eligible for redesignation.

Section 107 of the Clean Air Act (CAA) establishes specific requirements to be met in order for an area to be considered for redesignation including:

(a) A determination that the area has attained the annual standard for fine particles.
(b) An approved State Implementation Plan (SIP) for the area under Section 110(k).
(c) A determination that the improvement in air quality is due to permanent and enforceable reductions in emissions resulting from implementation of the SIP and other federal requirements.
(d) A fully approved maintenance plan under Section 175A.
(e) A determination that all Section 110 and Part D requirements have been met.

A maintenance plan provides for the continued attainment of the air quality standard by an area for a period of ten years after the United States Environmental Protection Agency (U.S. EPA) has formally redesignated the area to attainment. The plan also provides assurances that even if there is a subsequent exceedance of the air quality standard that measures in the maintenance plan will prevent any future occurrences through contingency measures that would be triggered.

This document addresses each of these requirements, and provides additional information to support continued compliance with the annual standard for fine particles.

1.1 Background

The Clean Air Act Amendments of 1990 (CAAA) requires areas designated nonattainment for the National Ambient Air Quality Standard (NAAQS) for particulate matter to develop SIPs to expeditiously attain and maintain the standard. In 1997, U.S. EPA set daily and annual air quality standards for fine particles (fine particulate matter), as shown in Table 1.1 below. The standards were legally challenged and upheld by the U.S. Supreme Court in February of 2001. In 1999 Indiana began monitoring for fine particles. The U.S. EPA designated areas in Indiana under the standards for fine particles on December 17, 2004 as attainment, nonattainment or unclassifiable, with an effective date of April 5, 2005. .

Table 1.1
National Ambient Air Quality Standards for Fine Particles

	Annual	**24-Hour**
1997 Fine Particles Standards ($PM_{2.5}$)	**15 µg/m^3** Annual arithmetic mean, averaged over 3 years	**65 µg/m^3** 24-hour average, 98th percentile, averaged over 3 years
2006 Fine Particles Standards ($PM_{2.5}$)	**15 µg/m^3** Annual arithmetic mean, averaged over 3 years	**35 µg/m^3** 24-hour average, 98th percentile, averaged over 3 years

Note: The Southwestern Indiana Area meets the 1997 and 2006 annual and 24-hour NAAQS for fine particles. The 24-hour design value for the area at the close of 2006 is 34 µg/m^3. Since this area is solely designated nonattainment under the 1997 annual standard for fine particles, this document addresses only addresses the annual standard.

On December 17, 2004, based on 2001-2003 monitoring data, U.S. EPA designated the Southwestern Indiana Area of Dubois, Vanderburgh and Warrick Counties; Montgomery Township in Gibson County, Ohio Township in Spencer County, and Washington Township in Pike County as basic nonattainment of the annual standard for fine particles, and subject to Section 107 CAA requirements, including the development of a plan to reduce oxides of nitrogen (NO_x), sulfur dioxide (SO_2) and direct $PM_{2.5}$ emissions and a demonstration that the area will meet the annual standard for fine particles by April 15, 2010. There were no monitors in Indiana that violated the 1997 24-hour standard for fine particles.

The Southwestern Indiana Area as defined in Sections 1.1 and 1.2 has not previously been subject to nonattainment area rulemakings for fine particles. However, Vanderburgh and Warrick Counties had been subject to nonattainment area rulemakings under the 1-hour and 8-hour ozone standards. The 1-hour ozone standard was revoked on June 15, 2005 and both Vanderburgh and Warrick Counties were redesignated to attainment and classified as maintenance under the 8-hour ozone standard on January 30, 2006.

1.2 Geographical Description

The Southwestern Indiana Area includes Dubois, Vanderburgh and Warrick Counties and Montgomery Township in Gibson County, Ohio Township in Spencer County, and Washington Township in Pike County and contains such cities as Evansville, Jasper, Yankeetown, Inglefield, Boonville, Huntingburg, Petersburg, Owensville, Ferdinand, Rockport, Chandler, Newburgh and Kasson. This area is depicted in Figure 3.1.

1.3 Status of Air Quality

Monitoring data for fine particles for the most recent three (3) years, 2004 through 2006, demonstrates that air quality has met the annual NAAQS for fine particles in the nonattainment area. This fact, accompanied by the permanent and enforceable reductions in emission levels discussed in Section 4.0, justifies a redesignation to attainment for the subject area based on Section 107(d)(3)(E) of the CAAA.

2.0 REQUIREMENTS FOR REDESIGNATION

2.1 General

Section 110 and Part D of the CAAA list a number of requirements that must be met by nonattainment areas prior to consideration for redesignation to attainment. In addition, U.S. EPA has published detailed guidance in a document entitled *Procedures for Processing Requests to Redesignate Areas to Attainment*, issued September 4, 1992, to Regional Air Directors. This document is hereafter referred to as "Redesignation Guidance". This Request for Redesignation and Maintenance Plan is based on the Redesignation Guidance, supplemented with additional guidance received from staff of the Regulatory Development Section of U.S. EPA Region V.

The subsections below refer in greater detail to the requirements listed in Section 1.0 of this document. Each subsection describes how the requirement has been met.

2.2 Fine Particles Monitoring

1) A demonstration that the annual standard for fine particles, as published in 40 CFR 50.4, has been attained. Fine particles monitoring data must show that violations of the annual ambient standard are no longer occurring.

2) Ambient monitoring data quality assured in accordance with 40 CFR 58.10, recorded in the U.S. EPA Air Quality System (AQS) database, and available for public view.

3) A showing that the three-year average of annual values, based on data from all monitoring sites in the area or its affected downwind environs, do

not exceed 15.0 micrograms per cubic meter ($\mu g/m^3$). This showing must rely on three complete, consecutive calendar years of quality assured data.

4) A commitment that, once redesignated, the State will continue to operate an appropriate monitoring network to verify the maintenance of the attainment status.

2.3 Emission Inventory

1) A comprehensive emission inventory of direct fine particles and the precursors of fine particles completed for the base year (2005 in this case).

2) A projection of the emission inventory to a year at least ten years following redesignation.

3) A demonstration that the projected level of emissions is sufficient to maintain the annual fine particles standard.

4) A demonstration that improvement in air quality between the year violations occurred and the year attainment was achieved is based on permanent and enforceable emission reductions and not on temporary adverse economic conditions or unusually favorable meteorology.

5) Provisions for future annual updates of the inventory to enable tracking of the emission levels, including an annual emission statement from major sources.

2.4 Modeling Demonstration

While no modeling is required for redesignating nonattainment areas, the Indiana Department of Environmental Management (IDEM) has evaluated the results of federal control-case modeling to demonstrate compliance with the standard will be maintained.

2.5 Controls and Regulations

1) A U.S. EPA-approved SIP control strategy that includes Reasonably Available Control Technology (RACT) requirements for existing stationary sources covered by Control Technology Guidelines (CTG) and non-CTG RACT for all major sources.

2) Evidence that control measures required in past SIP revisions have been fully implemented.

3) Acceptable provisions to provide for new source review.

4) Assurances that existing controls will remain in effect after redesignation, unless the State demonstrates through photochemical modeling that the standard can be maintained without one or more controls.

5) If appropriate, a commitment to adopt a requirement that all transportation plans conform with and are consistent with the SIP.

2.6 Corrective Actions for Potential Future Violations of the Fine Particles Standard

1) A commitment to submit a revised plan eight (8) years after redesignation.

2) A commitment to expeditiously enact and implement additional contingency control measures in response to exceeding specified predetermined levels (triggers) or in the event that future violations of the ambient standard occur.

3) A list of potential contingency measures that would be implemented in such an event.

4) A list of NO_x, SO_2, and direct $PM_{2.5}$ sources potentially subject to future controls.

3.0 FINE PARTICLES MONITORING

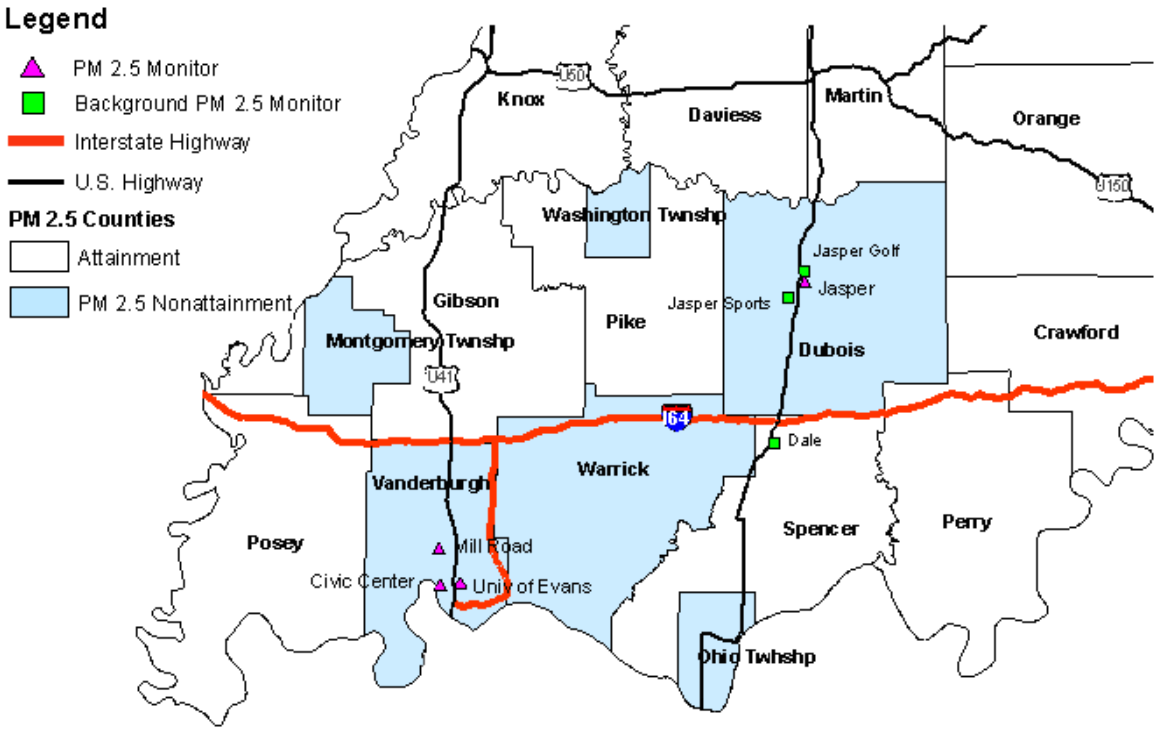
3.1 Fine Particles Monitoring Network

There are currently four monitors measuring fine particle concentrations in this nonattainment area. These monitors are located as follows: Dubois County (Jasper, Indiana), Vanderburgh County (Mill Road, Civic Center, University of Evansville; Evansville, Indiana). The four monitors are currently operated by IDEM's Office of Air Quality (OAQ). A listing of the monitor readings from 2004 through 2006 are shown in Table 3.1 and Appendix A and were retrieved from the U.S. EPA's Air Quality System (AQS). The locations of the monitoring sites for this nonattainment area are shown on Figure 3.1.

IDEM's OAQ also operates three monitors in the Southwestern Indiana geographic area that collect background fine particle concentrations. While these monitors are not used to determine attainment with the annual fine particles standard the monitoring values are included as supporting material.

Figure 3.1

Southwest Indiana Nonattainment Area



3.2 Ambient Fine Particles Monitoring Data

The following information is taken from U.S. EPA's "Guideline on Data Handling Conventions for the PM NAAQS," U.S. EPA-454/R-99-008, April 1999. Three complete years of fine particles monitoring data are required to demonstrate attainment at a monitoring site. The annual ambient air quality standard for fine particles is met at an ambient air quality monitoring site when the three year average of the annual average of fine particle concentrations is less than or equal to 15.0 µg/m^3. When this occurs, the site is said to be in attainment. Three significant digits must be carried in the computations and values are rounded to the nearest 0.1 µg/m^3. Round decimals 0.05 or greater up and those less than 0.05 down, 15.049 µg/m^3 is the largest concentration that is less than, or equal to 15.0 µg/m^3. Therefore, for the purposes of this request, the annual fine particles standard is considered to be 15.0 µg/m^3. Values at or below 15.0 µg/m^3meet the standard; values equal to or greater than 15.1 µg/m^3 exceed the standard. These data handling procedures are applied on an individual basis at each monitor in the area. An area is in compliance with the annual NAAQS for fine particles if, and only if, this monitoring site meets the NAAQS. An individual site's three year average of the annual average fine particles concentration is also called the site's *design value*. The air quality design value for the area is the highest design value among all sites in the area. Table 3.1 outlines the annual fine particles values by site and the 2004 through 2006 design values for the four active fine particles monitoring sites in the Southwestern Indiana Area.

Table 3.1

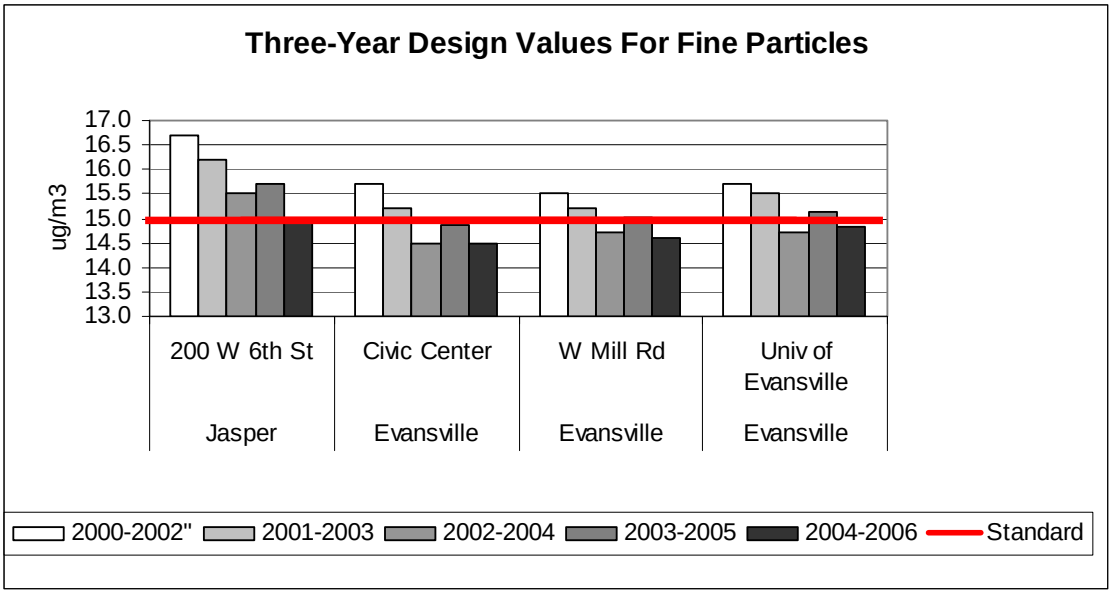
Monitoring Data for the Southwestern Indiana Area
(Annual Average and Design Values)

SITE ID	COUNTY	SITE NAME	YEAR	Annual Average µg/m^3	2004-2006 Average µg/m^3
18-037-2001	Dubois	Jasper	2004	14.42	
18-037-2001	Dubois	Jasper	2005	16.92	
18-037-2001	Dubois	Jasper	2006	13.54	**15.0**
18-163-0006	Vanderburgh	Civic Center	2004	13.23	
18-163-0006	Vanderburgh	Civic Center	2005	16.49	
18-163-0006	Vanderburgh	Civic Center	2006	13.72	**14.5**
18-163-0012	Vanderburgh	Mill Road	2004	13.46	
18-163-0012	Vanderburgh	Mill Road	2005	16.29	
18-163-0012	Vanderburgh	Mill Road	2006	14.05	**14.6**
18-163-0016	Vanderburgh	Univ of Evansville	2004	13.68	
18-163-0016	Vanderburgh	Univ of Evansville	2005	16.67	
18-163-0016	Vanderburgh	Univ of Evansville	2006	14.15	**14.8***

**incomplete data, see Appendix C*

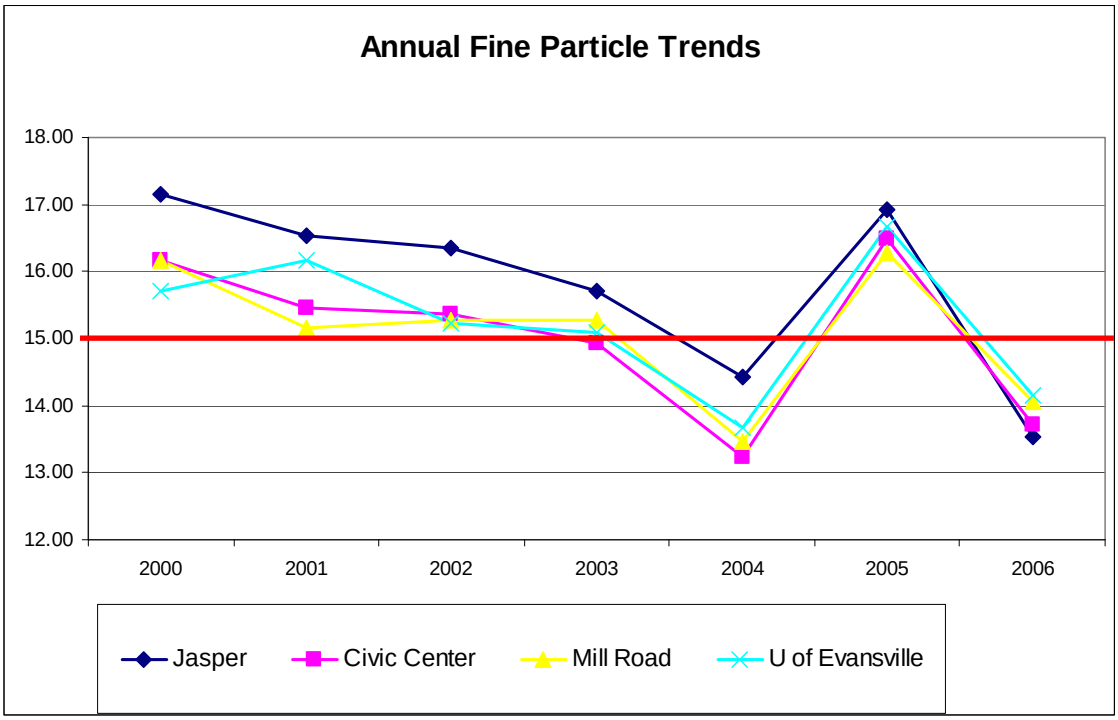
The graph below visually demonstrates the 2004 through 2006 design values for this nonattainment area.

Graph 3.1
Design Values for the Southwestern Indiana Nonattainment Area for Fine Particles, 2000 through 2006



Graph 3.2

Southwestern Indiana Annual Fine Particle Trends, 2000 through 2006



The design values calculated for the Southwestern Indiana Nonattainment Area demonstrates that the annual NAAQS for fine particles has been attained.

Graph 3.1 shows the trend in design values for the region over the past several years, while graph 3.2 shows the annual fine particle trends. A comprehensive list of the four fine particle monitoring sites' design values over this period is outlined within Appendices A and B. The area's design values have recently trended downward, as emissions have declined due to such programs as the Acid Rain program and cleaner automobiles and fuels both regionally and locally. U.S. EPA's rule to control nitrogen oxides from specific source categories (40 CFR Parts 51, 72, 75 and 96, published on October 17, 1998 and referred to as the "NO_x SIP Call") has significantly reduced emissions from large electric generating units (EGUs), industrial boilers, and cement kilns. Indiana's NO_x Rule was adopted on June 6, 2001 (326 IAC 10-3 and 10-4). The elevated value for 2005 is considered an abnormal occurrence. An analysis of meteorological conditions and monitoring values is included in Section 7.0 and supports the conclusion that attainment of the standard as of 2006 is not the result of unusually favorable meteorological conditions. It is expected that this downward trend will continue as the above programs continue and the U.S. EPA Clean Air Interstate Rule is implemented.

3.3 University of Evansville Incomplete Monitoring Data

During the second quarter of 2005 the University of Evansville (UE) monitor located in Vanderburgh County, Indiana, Site ID 18-163-0016, recorded an overall Valid Data Return (VDR) for fine particles of 68%. According to U.S. EPA guidance, the monitoring data for 2004-2006 (14.8 $\mu g/m^3$) for the University of Evansville monitor located in Vanderburgh County, Indiana is incomplete. The U.S. EPA required VDR is 75%. Therefore, an analysis of missing data during the second quarter of 2005 was conducted and is detailed in Appendix C. According to the *Guideline on Data Handling Conventions for the PM NAAQS*, issued April 1999, U.S. EPA states that the incomplete design value of 14.8 $\mu g/m^3$, is still identified as the monitors true design value.

3.4 Quality Assurance

IDEM has quality assured all data shown in Appendices A and B in accordance with 40 CFR 58.10 and the Indiana Quality Assurance Manual. IDEM has recorded the data in the AQS database and, thus, the data are available to the public.

3.5 Continued Monitoring

Indiana commits to continue monitoring concentrations of fine particles at the sites indicated in Table 3.1 and Appendices A and B. IDEM will consult with U.S. EPA Region V staff prior to making changes to the existing monitoring network, should changes become necessary in the future. IDEM will continue to quality assure the monitoring data to meet the requirements of 40 CFR 58. IDEM will enter all data into AQS on a timely basis in accordance with federal guidelines.

4.0 EMISSIONS INVENTORY

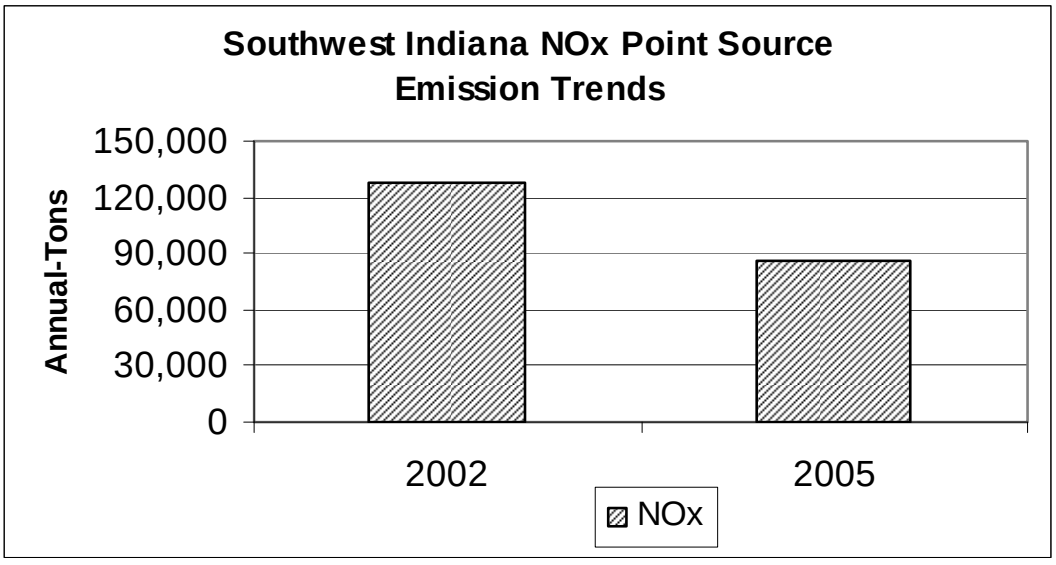
U.S. EPA's Redesignation Guidance requires the submittal of a comprehensive inventory of precursor emissions for fine particles (SO_2, direct $PM_{2.5}$ and NO_x) representative of the year when the area achieves attainment of the NAAQS for annual fine particles (base year). Indiana is using 2005 as the base year because it represents the center of the three-year design value. Indiana must also demonstrate that the improvement in air quality between the year that violations occurred and the year that attainment was achieved is based on permanent and enforceable emission reductions. Other emission inventory related requirements: include a projection of the emission inventory to a year at least ten (10) years following redesignation; a demonstration that the projected level of emissions is sufficient to maintain the annual fine particles standard; and a commitment to provide future updates of the inventory to enable tracking of emission levels during the ten (10) year maintenance period. Consistent with the federal implementation rule for fine particles, Indiana does not consider volatile organic compounds or ammonia to be significant contributors to fine particles. The following subsections address each of these requirements.

4.1 Emission Trends

Point Sources

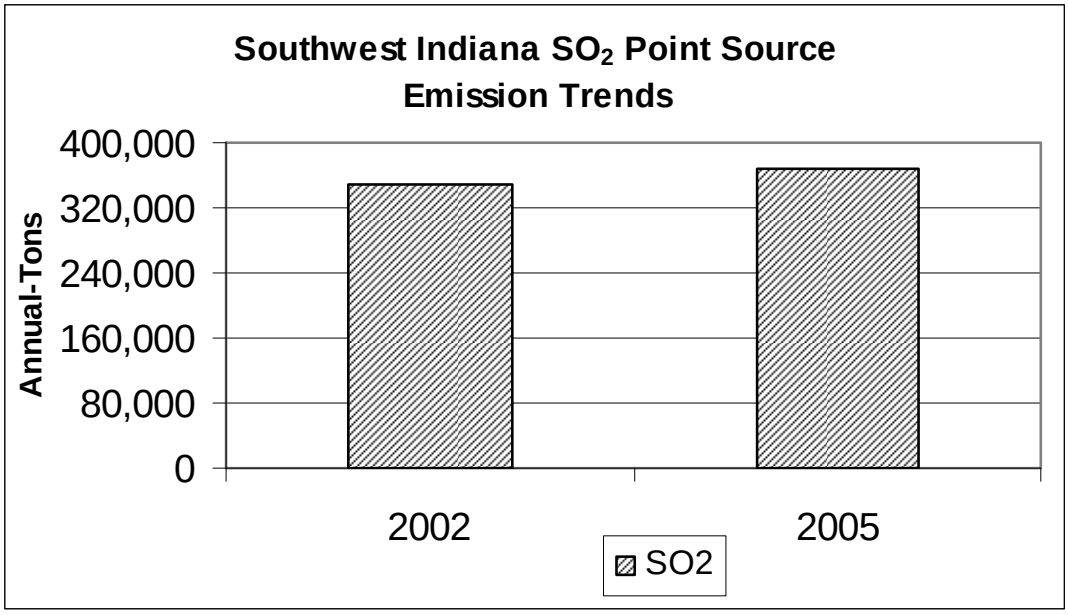
Graphs 4.1, 4.2 and 4.3 below show the trend in point source emissions of NO_x, SO_2 and direct $PM_{2.5}$ respectively that generally correspond to the years of monitored values used in this report. The point source data are taken from Indiana's annual emissions reporting program. The Southwestern Indiana Area had a 32% reduction in NO_x point source emissions, and a slight increase (4.8%) in SO_2 point source emissions. A moderate increase in direct $PM_{2.5}$ point source emissions is noted, but this increase in direct $PM_{2.5}$ emissions from 2002 to 2005 is due to the fact that most companies did not submit their direct $PM_{2.5}$ emissions data in 2002 but were included in the 2005 emissions inventory. Though a moderate increase in direct $PM_{2.5}$ point source emissions is depicted, the total anthropogenic direct $PM_{2.5}$ emissions have remained consistent within this period. See Graph 4.6 depicting the trend of $PM_{2.5}$ emissions from all anthropogenic sources. Regional NO_x emission reductions affect fine particle levels in the Southwestern Indiana Area far more so than NO_x emission reductions within the area itself. As Graph 4.7 illustrates, Southwest Indiana NO_x emissions from electric generating units have decreased substantially during this time period as well. Graphs and data tables of emissions from each source category are available in Appendix E.

Graph 4.1
Southwestern Indiana Area NO_x Point Source Emission Trends
2002 and 2005

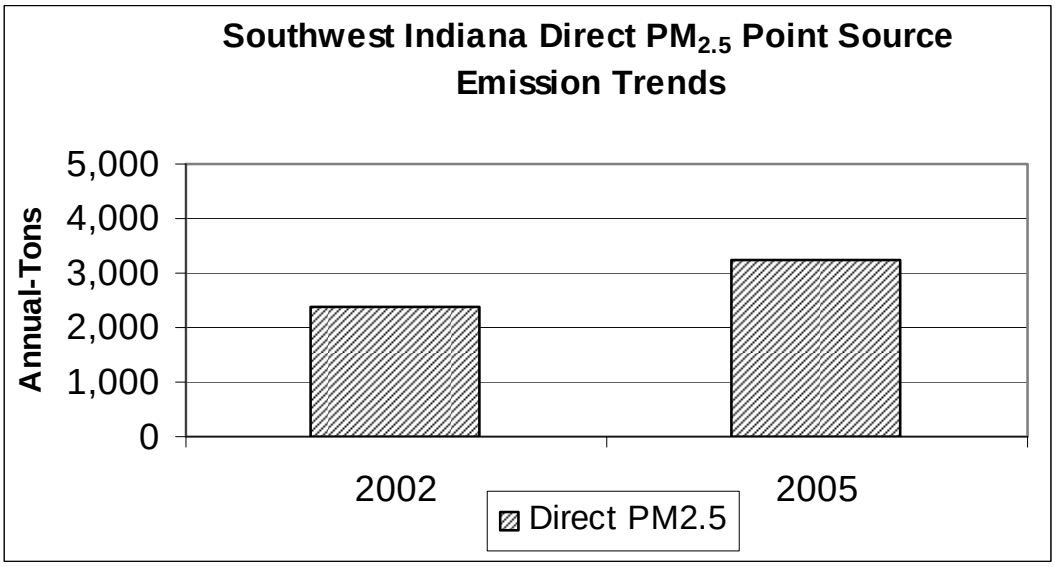


Graph 4.2
Southwestern Indiana Area SO_2 Point Source Emission Trends

2002 and 2005



Graph 4.3
Southwestern Indiana Area Direct $PM_{2.5}$ Point Source Emission Trends
2002 and 2005

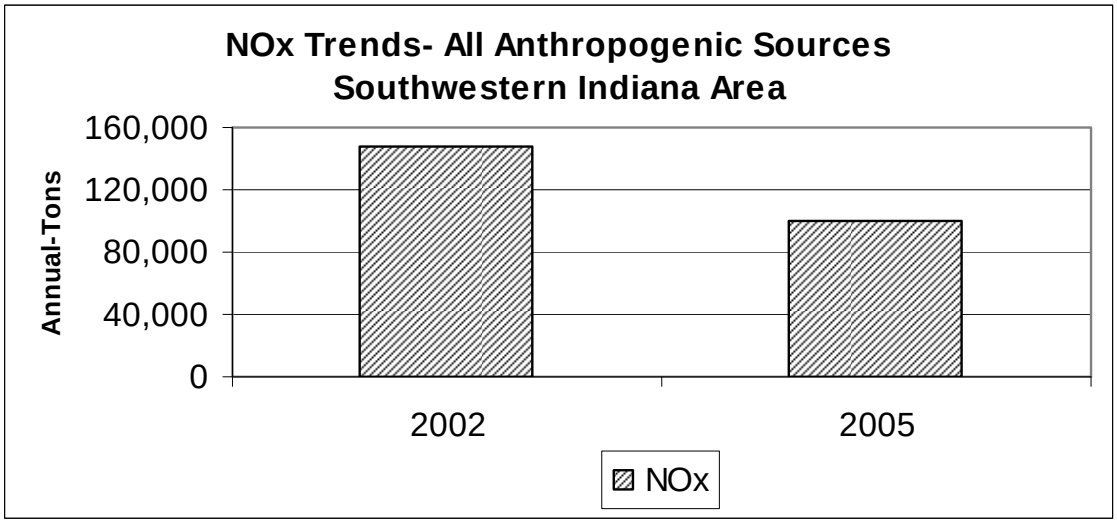


All Anthropogenic Sources

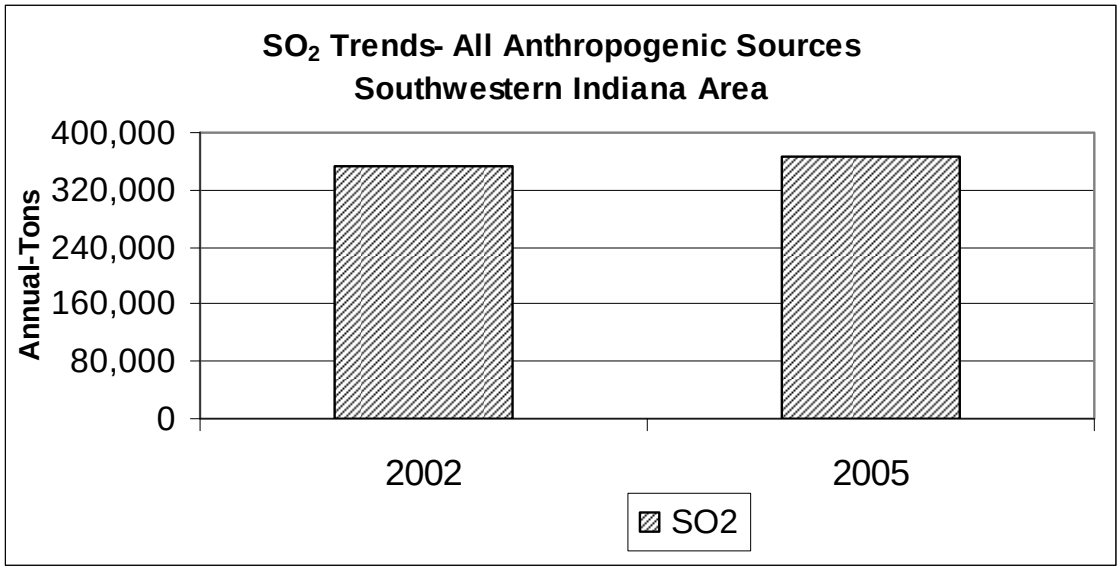
Periodic inventories, which include emissions from all sectors (mobile, area, non-road,

and point sources), were prepared for 2002 and 2005. Graphs 4.4, 4.5 and 4.6 show the trends for the total emissions for all anthropogenic source categories in these years, for NO_x, SO_2 and direct $PM_{2.5}$, which also roughly follow the years of monitored trends discussed in Section 3. Graph 4.5 shows a slight increase in SO_2 over time but as can be seen from the graphs there is a downward trend in NO_x and direct $PM_{2.5}$ emissions from 2002 to 2005. The decrease in NO_x can be largely attributed to those EGUs located within and surrounding the Southwestern Indiana Area that have reduced their NO_x emissions as a result of the NO_x SIP Call. The direct $PM_{2.5}$ emission decreases correspond to the trend in direct $PM_{2.5}$ concentrations monitored from 2004-2006 discussed in Section 3.0. Graphs and data tables of emissions from each source category are available in Appendix F.

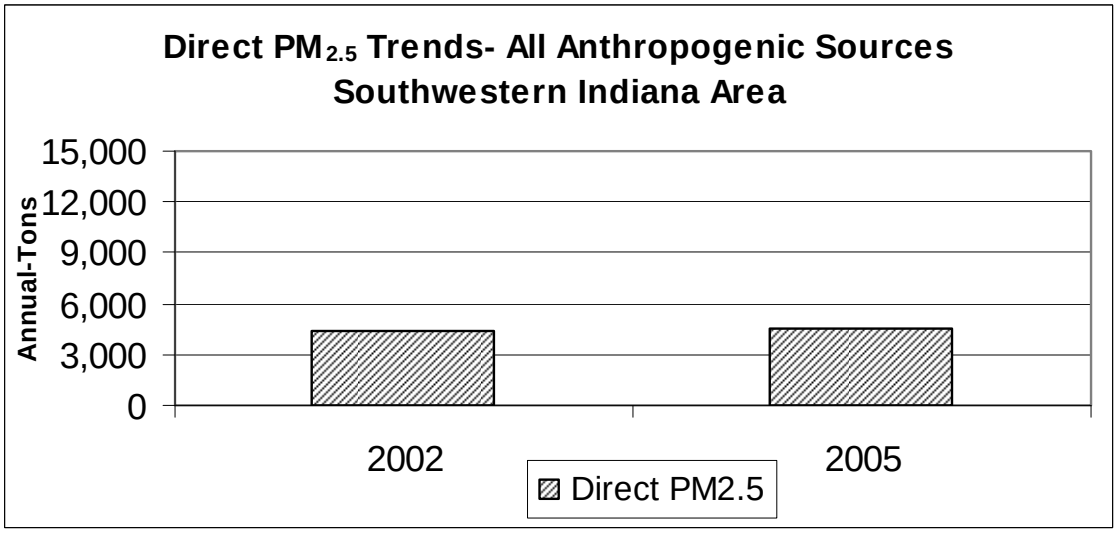
Graph 4.4
NO_x Emission Trends, All Sources in the Southwestern Indiana Area
2002 and 2005



Graph 4.5
SO_2 Emission Trends, All Sources in the Southwestern Indiana Area
2002 and 2005



Graph 4.6
Direct $PM_{2.5}$ Emission Trends, All Sources in the Southwestern Indiana Area
2002 and 2005



EGU Sources

Graphs 4.7 and 4.8 depict the trends in NO_x and SO_2 emissions from Southwest Indiana EGUs for the years 1999 to 2006. While fine particles and its precursors are transported

into this region from outside the area, this information does provide some indication of the impact that Indiana EGU sources may have on the nonattainment area. NO_x emissions are decreasing substantially in response to national programs affecting all EGUs such as the Acid Rain program and the NO_x SIP Call. Other sectors of the inventory also impact the formation of fine particles, but large regional sources such as EGUs have a substantial impact on the formation of fine particles.

These data were taken from U.S. EPA's Clean Air Markets database[1]. Data are available sooner for these units than other point sources in the inventory because of the NO_x SIP Call budget and trading requirements. Information from 2003 is significant because some EGUs started operation of their NO_x SIP Call controls in order to generate Early Reduction Credits for their future year NO_x budgets. The first season of the SIP Call budget period began May 31, 2004.

As part of the NO_x SIP Call, the states were required to adopt into their rules a budget for all large EGUs. Indiana's budget is referenced in 326 IAC 10-4. The budget represents a statewide cap on NO_x emissions. Although each unit is allocated emissions based upon historic heat input, utilities can meet this budget by over-controlling certain units or purchasing credits from the market to account for overages at other units. To summarize, NO_x emissions have dramatically decreased over the years represented on these graphs. These emissions, capped by the state rule, are expected to remain at least this low through the maintenance period covered by this request. However, since EGUs can purchase allowances from out of state, there is a possibility for NOX emissions to increase. The state cap for the NOx SIP Call will stay in place through 2008, at which time the Clean Air Interstate Rule (CAIR) program will supersede it. The Clean Air Interstate Rule (CAIR), issued in March 2005, adopted by the Indiana Air Pollution Control Board on November 1, 2006, and to be implemented by 2010, will reduce regional EGU NOx emissions statewide by approximately another 17% in 2015.

As demonstrated by Figure 4.1, significant reductions of NO_x associated with the NO_x SIP Call and preparation for CAIR have been achieved statewide as well as regionally. For the six state (Arkansas, Indiana, Illinois, Kentucky, Missouri and Tennessee) region shown in Figure 4.1 (the area south of latitude 38 and west of longitude -87 (the southwest quadrant denoted by brown lines)) there has been a reduction in upwind EGU emissions of more than 72,000 tons of NOx from 2002 to 2006. The specific EGU emissions for NOx and SO2 from the southwest quadrant, as well as the change in emissions from 2002 to 2006 are listed in Appendix H.

Graph 4.7
NO_x Emissions from Electric Generating Units, 1999 to 2006

[1] http://www.epa.gov/airmarkets

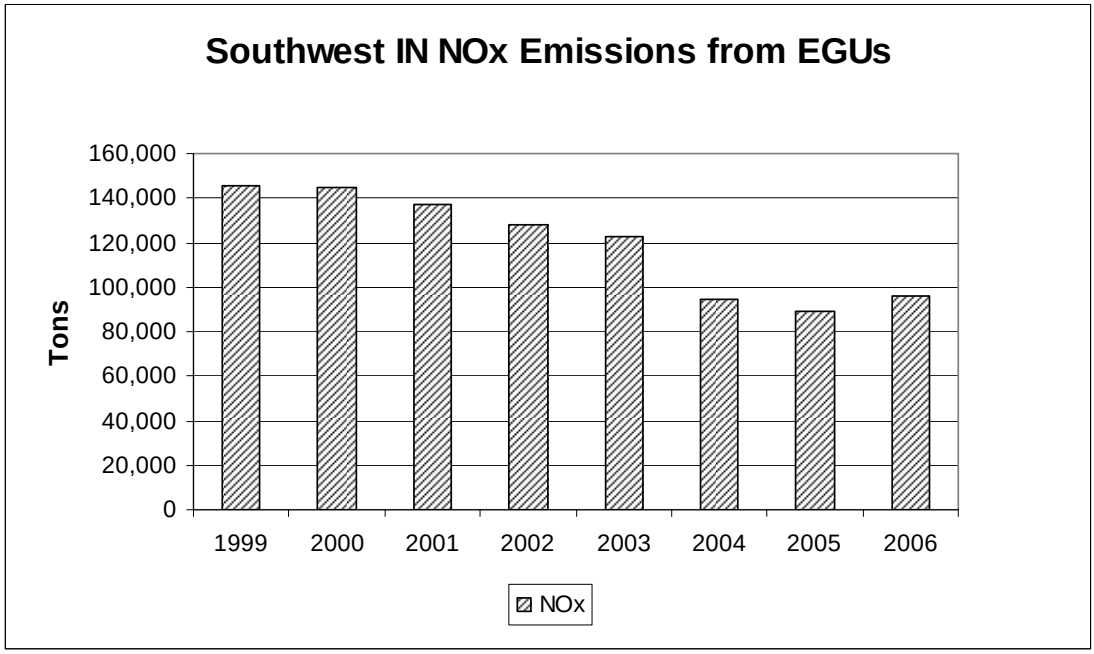
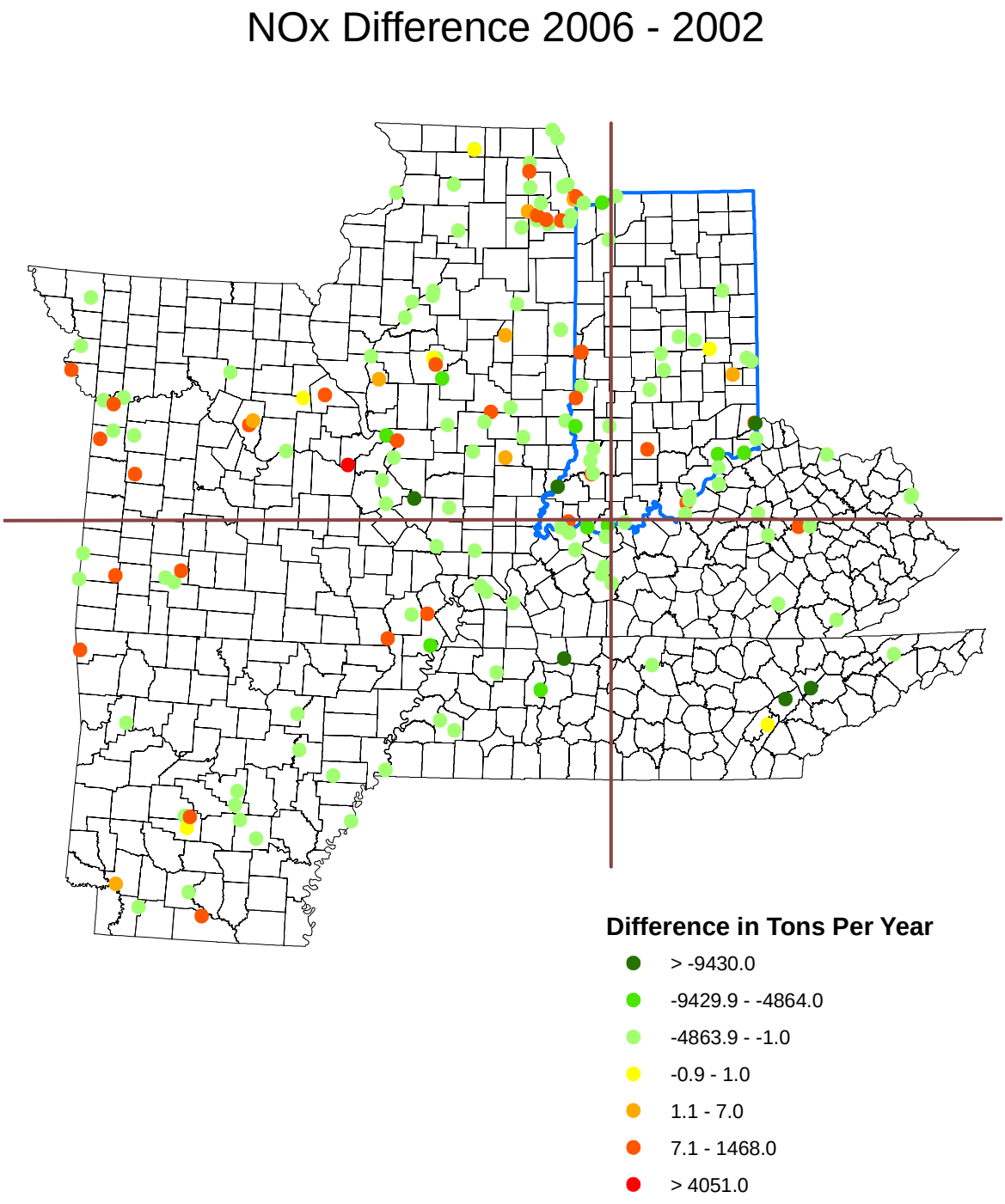

Southwest IN NOx Emissions from EGUs
Tons
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
1999
2000
2001
2002
2003
2004
2005
2006
NOx

Figure 4.1 Regional NO_x Reductions Between 2002 and 2006



Although there are minor fluctuations in the SO_2 emissions over time, as shown in Graph 4.8, there are moderate reductions to date. As noted by Graph 4.10 we do expect to see significant reductions in SO_2 emissions from CAIR and BART (Best Available Retrofit Technology), once implemented. As a result of CAIR, five EGU's will achieve significant reductions in SO_2. ALCOA will install scrubbers on all units by 2008 that will result in a 90% reduction in SO_2 emissions. Cayuga, Clifty Creek and Wabash Valley are in the process of installing Flue Gas Desulfurization (FGD) systems which will also result in 90% reductions in SO_2 at those facilities. Edwardsport is replacing all of the coal fired boilers with an Integrated Gasification Combined Cycle (IGCC) system which will result in a slight increase in NO_x of 32.49 tons per year and a huge reduction in SO2 of 9,834 tons per year. Also, as a result of a recent settlement agreement, AEP Rockport is installing scrubbers to achieve a 90% reduction in SO_2. Appendix E shows detailed emissions for the point source emissions, and Appendix G shows detailed emissions for the Electric Generating Units.

As demonstrated by Figure 4.2, reductions of regional SO_2 from upwind EGUs have also been achieved. For the six state (Arkansas, Indiana, Illinois, Kentucky, Missouri and Tennessee) region shown in Figure 4.2 (the area south of latitude 38 and west of longitude -87 (the southwest quadrant denoted by the brown lines)) there has been a reduction of upwind EGU emissions of nearly 15,000 tons of SO_2 from 2002 to 2006. The specific EGU emissions for NO_x and SO_2 from the southwest quadrant, as well as the change from 2002 to 2006 are listed in Appendix H.

Graph 4.8
SO_2 Emissions from Electric Generating Units, 1999 to 2006

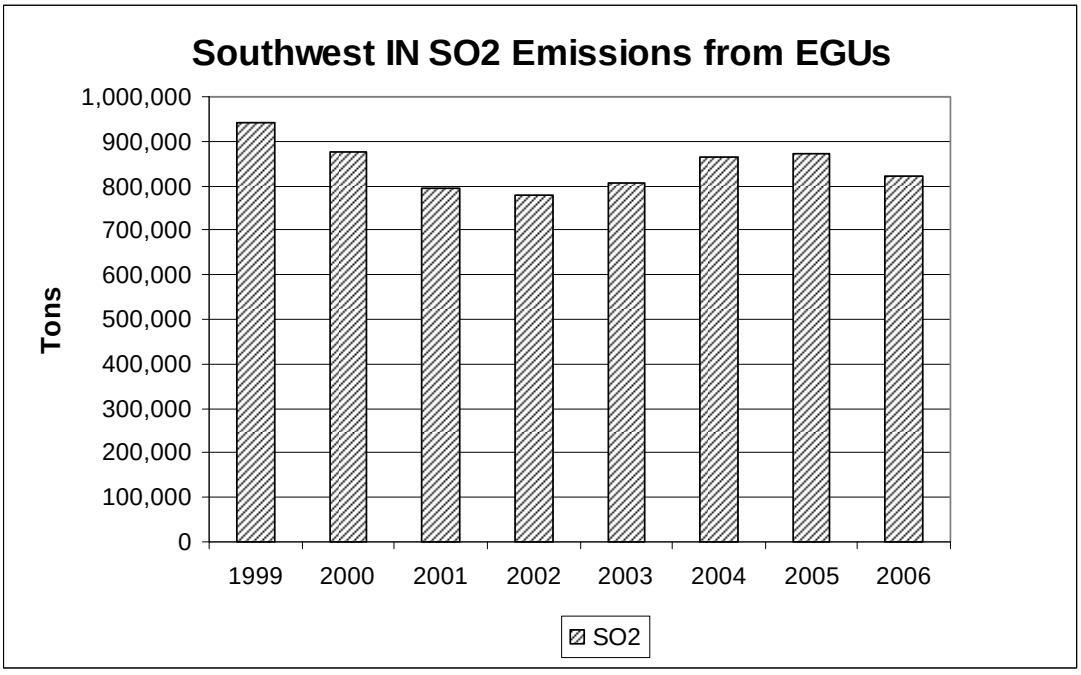
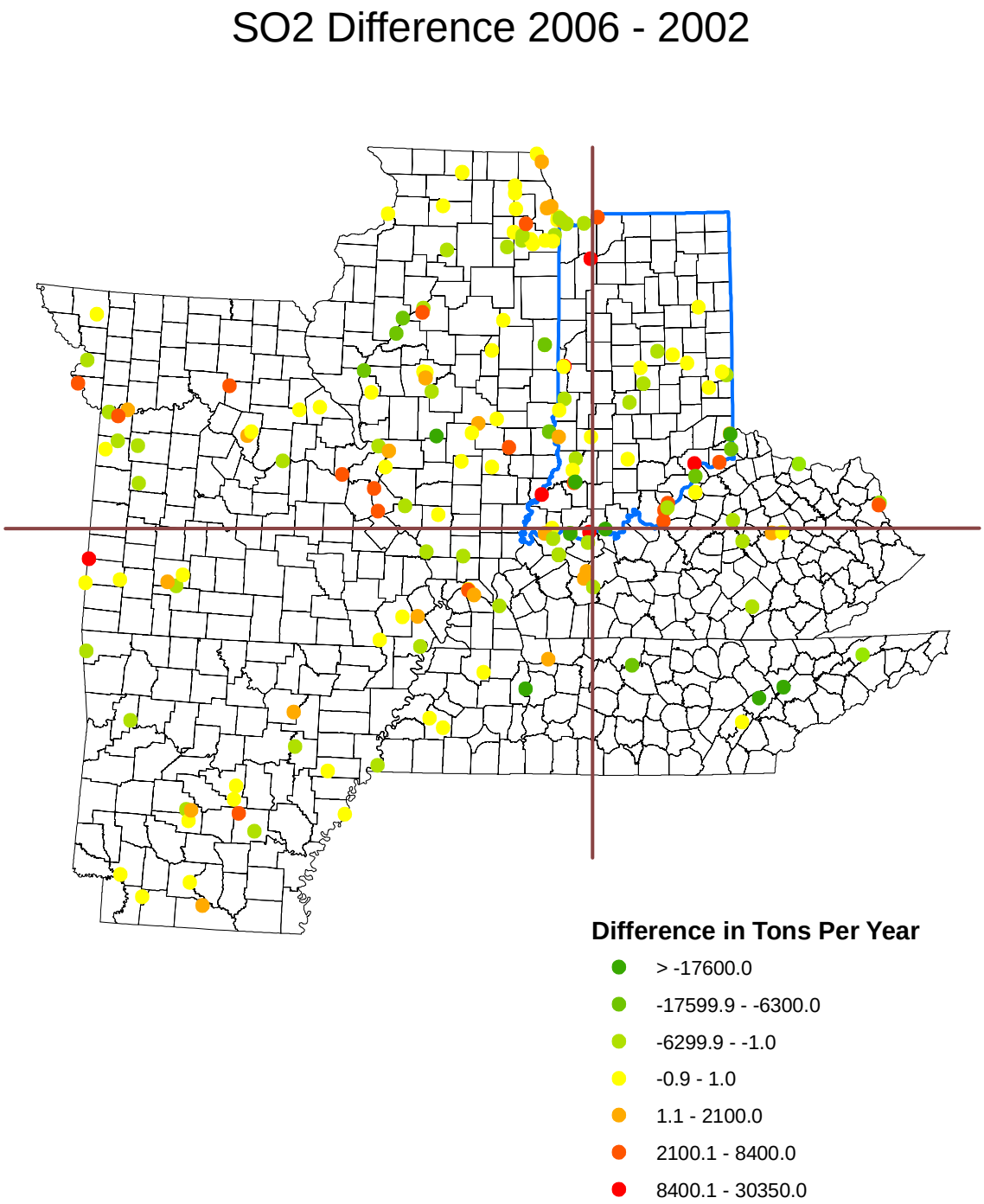


Figure 4.2 Regional SO_2 Reductions Between 2002 and 2006



4.2 Base Year Inventory

IDEM prepared a comprehensive inventory for the Southwestern Indiana Area, including area, mobile, non-road and point sources for direct $PM_{2.5}$ and precursors of fine particles for base year 2005 (the middle year of the area's attainment design value).

- Area sources were grown from the Indiana 2002 periodic inventory submitted to U.S. EPA.
- Mobile source emissions were calculated from MOBILE 6.2 produced emission factors and data extracted from the region's travel-demand model. These emissions were then interpolated as needed to determine 2005 base year values.
- Point source information was compiled from IDEM's annual emissions statement database.
- Biogenic emissions are not included in these summaries.
- Nonroad emissions were grown from the 2002 National Emissions Inventory (NEI). To address concerns about the accuracy of some of the categories in U.S. EPA's nonroad emissions model, the Lake Michigan Air Directors' Consortium (LADCO) (Midwest Regional Planning Organization), contracted with two (2) companies to review the base data and make recommendations. One of the contractors also estimated emissions for two (2) nonroad categories not included in U.S. EPA's nonroad model. Emissions were estimated for commercial marine vessels and railroads. Recreational motorboat population and spatial surrogates (used to assign emissions to each) were significantly updated. The populations for the construction equipment category were reviewed and updated based upon surveys completed in the Midwest and the temporal allocation for agricultural sources was also updated. A new nonroad estimation model was provided by U.S. EPA for the 2002 analysis.

Appendix I contains data tables and graphs of all these emissions.

4.3 Emission Projections

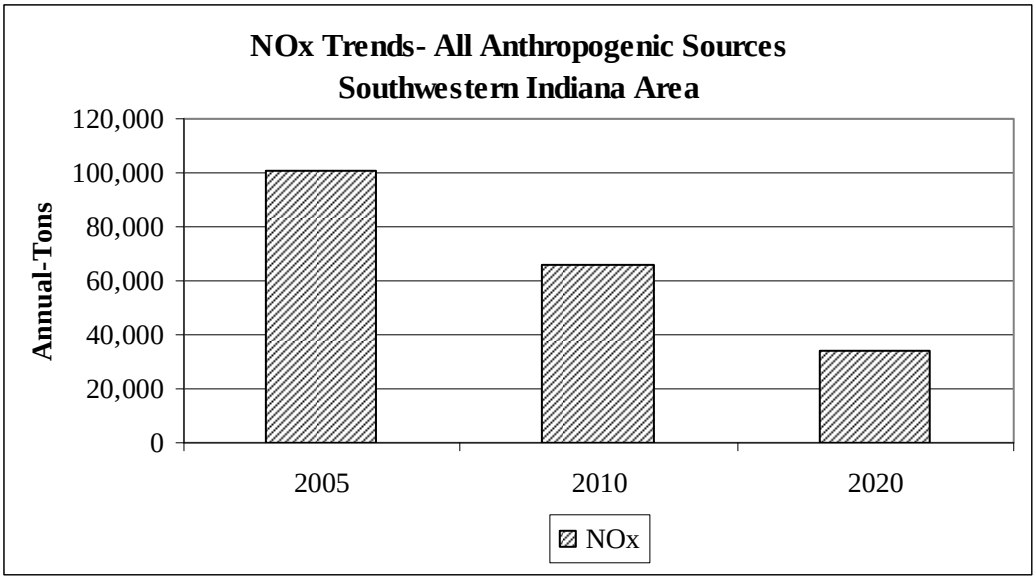
In consultation with the U.S. EPA and other stakeholders, IDEM selected the year 2020 as the maintenance year for this redesignation request. This document contains projected emission inventories for 2010 and 2020[3] for the Southwestern Indiana Area. These emission projections were prepared by IDEM, with assistance from LADCO and the Evansville Metropolitan Planning Organization.

The detailed inventory information for the Southwestern Indiana Area for 2010 and 2020[3] is in Appendix H. Emission trends are an important gauge for continued compliance with the annual standard for fine particles. Therefore, IDEM performed an initial comparison of the inventories for the base year (2005), interim year (2010), and maintenance year (2020)[3] inventories for the Southwestern Indiana Area which are summarized below. Graphs 4.9, 4.10 and 4.11 visually compare 2005 (base year) NO_x, SO_2 and direct $PM_{2.5}$ estimated emissions with the 2010 and 2020[2] projected emissions

[2] EGU emission projections for the year 2020 are based on 2018 emission estimates

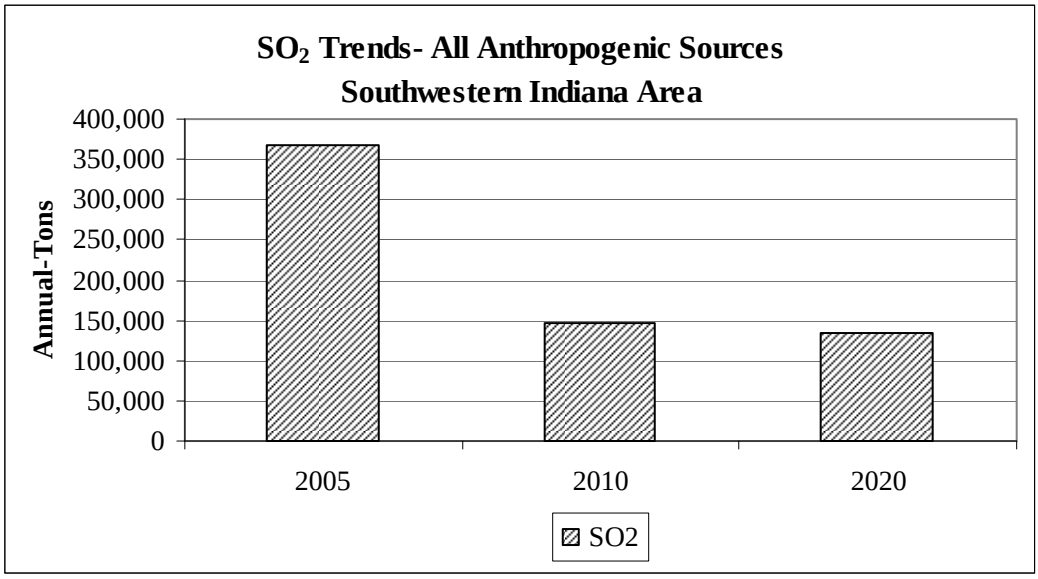
for the Southwestern Indiana Area. Mobile source emission inventories are described in Section 5.0. In addition to LADCO's estimates, point source emissions were projected based upon the statewide EGU NO_x budgets from the Indiana NO_x rule. It should be noted that EGU emission estimates for 2010 and 2020 (i.e. 2018) were projected utilizing Annual Energy Outlook Supplemental tables. These tables were generated for the reference case of the Annual Energy Outlook 2007 (AEO 2007) using the National Energy Modeling System.

Graph 4.9
Comparison of 2005 Estimated and 2010 and 2020[3] Projected NO_x Emissions for the Southwestern Indiana Area



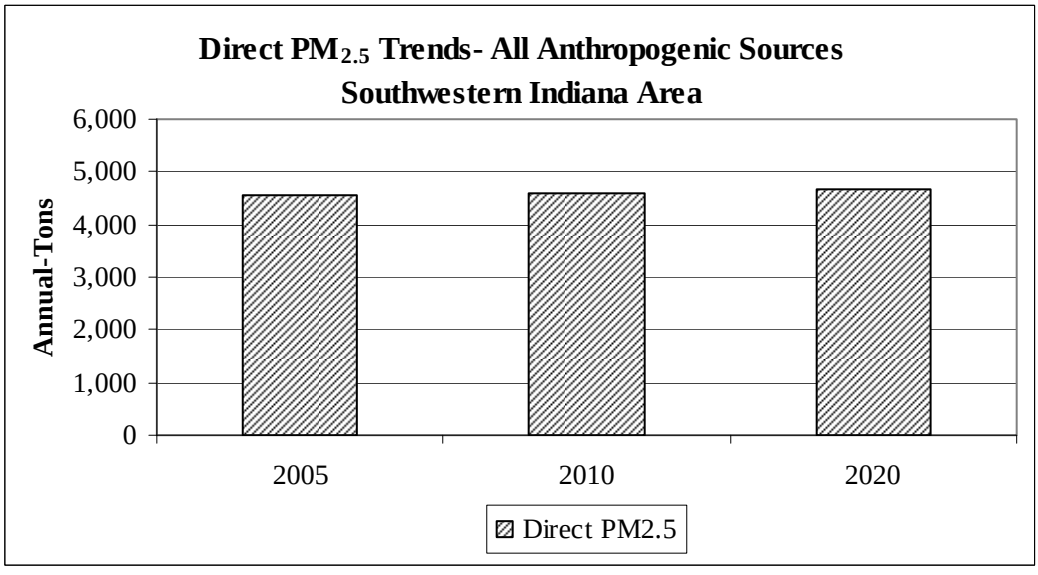
Graph 4.10

Comparison of 2005 Estimated and 2010 and 2020[3] Projected SO_2 Emissions for the Southwestern Indiana Area



Graph 4.11

Comparison of 2005 Estimated and 2010 and 2020[4] Projected Direct $PM_{2.5}$ Emissions for the Southwestern Indiana Area



Graph 4.12

[3] EGU emission projections for the year 2020 are based on 2018 emission estimates

Comparison of 2005 Estimated and 2010 and 2020[4] Projected SO_2, NO_x, and Direct $PM_{2.5}$ Emission Trends for the Southwestern Indiana Area

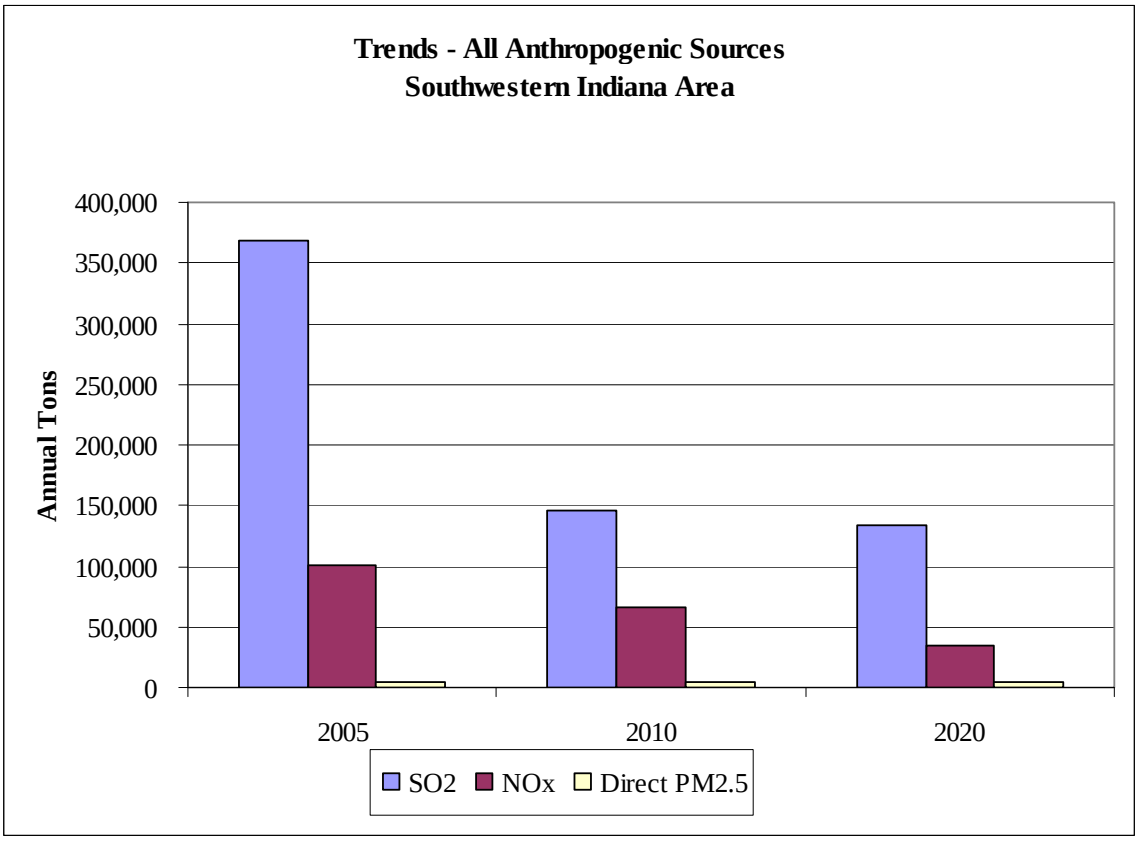


Table 4.1
Comparison of 2005 Estimated and 2020[5] Projected Emission Estimates Southwestern Indiana Area, (Annual-tons)

	2005	2020	Change	% Change
NO_x	100,738.05	33,920.55	-66,817.5	66.33% decrease
SO_2	367,861.51	133,918.53	-233,942.98	63.60% decrease
Direct $PM_{2.5}$	4,566.88	4,688.54	121.66	2.66% increase

NO_x emissions within the Southwestern Indiana Area are projected to decline by 66.33% between 2005 and 2020[5]. Emission reduction benefits from U.S. EPA rules covering the NO_x SIP Call, Tier 2 Motor Vehicle Emissions Standards and Gasoline Sulfur Control Requirements, Highway Heavy-Duty Engine Rule and Non-Road Diesel Engine Rule are factored into the changes. Further, due to implementation of the NO_x SIP Call across the eastern United States, NO_x and ozone levels entering this area will also be decreased.

[4] EGU emission projections for the year 2020 are based on 2018 emission estimates

Since CAIR is a regional cap and trade program, it cannot be predicted at this time what effect this will have on EGU units located in the Southwestern Indiana Area or other upwind counties. Therefore, potential reductions are **not** included in Graph 4.9 or Table 4.1. SO_2 emissions within the Southwestern Indiana Area are projected to decline by 63.60% between 2005 and 2020[5]. The nominal 2.66% increase in direct $PM_{2.5}$ emissions from 2005 to 2020[6] is outweighed by the significant SO_2 and NO_x reductions.

4.4 Demonstration of Maintenance

Ambient air quality data from all the monitoring sites indicate that air quality in the Southwestern Indiana Area met the annual standard for fine particles for the three-year period ending in 2006. U.S. EPA's Redesignation Guidance (Page 9) states, "A state may generally demonstrate maintenance of the NAAQS by either showing that future emissions of a pollutant or its precursors will not exceed the level of the attainment inventory, or by modeling to show that the future mix of sources and emissions rates will not cause a violation of the NAAQS**."** Emissions projections outlined in Section 4.0 of this document clearly illustrate that NO_x, SO_2 and direct $PM_{2.5}$ emissions will continue to decline between 2005 (base year) and 2020[6] (maintenance plan horizon). Section 7.0 further discusses the implications of these emission trends and provides an analysis to support these conclusions. Therefore, air quality should meet the NAAQS for annual fine particles through the projected years of 2010 and 2020.

In Indiana, major point sources in all counties are required to submit air emissions information once every three years or annually if SO_2 potential to emit is greater than 2**,**500 (see 326 IAC 2-6-3(a)(1)(D)) tons or the NO_x potential to emit is greater than 2,500 tons, in accordance with the Emission Statement Rule, 326 IAC 2-6. IDEM prepares a new periodic inventory for all precursor emission sectors every three (3) years. These precursor emission inventories will be prepared for 2008, 2011, 2014 and 2017 as necessary to comply with the inventory reporting requirements established in the CAAA. Emissions information will be compared to the 2005 base year and the 2020[6] projected maintenance year inventories to assess emission trends, as necessary, to assure continued compliance with the annual fine particles standard.

4.5 Permanent and Enforceable Emission Reductions

Permanent and enforceable reductions of sulfur dioxides, direct $PM_{2.5}$ and oxides of nitrogen have contributed to the attainment of the annual standard for fine particles. Some of these reductions were due to the implementation of the NO_x SIP Call, and some were due to the application of tighter federal standards on motor vehicles and fuels. Section 6.0 identifies the emission control measures specific to the Southwestern Indiana Area, as well as the implementation status of each measure.

4.6 Provisions for Future Updates

[5] EGU emission projections for the year 2020 are based on 2018 emission estimates

As required by Section 175A(b) of the CAAA, Indiana commits to submit to the Administrator, eight years after redesignation, an additional revision of this SIP. The revision will contain Indiana's plan for maintaining the national primary fine particles air quality standard for ten years beyond the first ten year period after redesignation.

5.0 TRANSPORTATION CONFORMITY BUDGETS

5.1 On-Road Emission Estimations

The Evansville Metropolitan Planning Organization (EMPO) is the Metropolitan Planning Organization (MPO) for the Evansville area. The EMPO study area contains approximately 650 square miles in Indiana, including the City of Evansville, Vanderburgh County, Warrick County, and a very small area of eastern Posey County. In Kentucky, the study area encompasses approximately 440 square miles which includes the City of Henderson and Henderson County. Additionally, the Indiana Department of Transportation and the EMPO have executed an agreement for the EMPO to provide planning assistance in the rural counties of Gibson and Posey.

The Evansville MPO maintains a travel demand model that was updated and improved in 2003. The model incorporates the road network of a 5-county area, which includes the Indiana counties of Vanderburgh, Warrick, Gibson and Posey, and Henderson County in Kentucky. Incorporated into the travel demand model is a post-processor that uses the U.S. EPA-required emissions estimation model MOBILE6.2 to calculate total emissions.

The EMPO travel demand model is then used to simulate the traffic in the area and is used to predict what the traffic would be like in future years given growth expectations. The model is used mostly to identify where travel capacity will be needed and to determine the infrastructure requirements necessary to meet that need. It is also used to support the calculation of mobile source emissions. The travel demand model is used to predict the total daily Vehicle Miles Traveled (VMT) and a U.S. EPA software program called MOBILE 6.2 is used to calculate the emissions per mile. The product of these two outputs, once combined, is the total amount of pollution emitted by the on-road vehicles for the particular analyzed area.

Dubois County, Ohio Township in Spencer County and Washington Township in Pike County were Indiana areas included in U.S. EPA's nonattainment designations for fine particles and do not fall under the jurisdiction of EMPO. In cases such as this, the Indiana Department of Transportation (INDOT) uses Highway Performance Monitoring System (HMPS) baseline data to estimate and project mobile source emissions. This is a national program that requires state Departments of Transportation to collect traffic counts throughout the state on a regular basis under a certain regulated method. This HPMS data was collected and provided by the INDOT and was used for these three areas beyond Evansville MPO's jurisdiction.

5.2 Overview

Broadly described, MOBILE 6.2 is used to determine "emission factors", which are the average emissions per mile (grams/mile) for direct $PM_{2.5}$ and $PM_{2.5}$ precursors including NO_x and SO_2. There are numerous variables that can affect the emission factors. The vehicle-fleet (vehicles on the road) age and the vehicle types have a major effect on the emission factors. The facility-type the vehicles are traveling on (MOBILE 6.2 facility-types are Freeway, Arterial, Local and Ramp) and the vehicle speeds also affect the emission factor values. Meteorological factors such as air temperature and humidity affect the emission factors and any Vehicle Inspection/Maintenance program in the area will also affect emissions. After emission factors are determined, the emission factor(s) must be multiplied by the VMT to determine the quantity of vehicle-related emissions. This information derives from the travel demand model.

It should be noted that each year analyzed will have different emission factors, volumes, speeds and likely some additional links such as roads. MOBILE6.2 input and output files can be found in Appendix J.

5.3 Analysis Years

The travel demand model contains road networks that are time specific. The EMPO has modeled the years 2002, 2010, 2015, 2025, and 2035. Information, including emissions, has also been interpolated from 2002 and 2010 for the year 2005 and from 2015 and 2025 for the year 2020. This Redesignation Petition provides emission inventory estimates for 2002, 2005, 2010 and 2020 to meet the requirements specified by the Clean Air Act and the U.S. EPA. The emissions estimates outlined in Section 4 of this document include the 2005, 2010 and 2020 mobile source emissions data referenced below in Table 5.1.

5.4 Emission Estimations

Table 5.1 outlines predicted VMT and on-road emissions estimates for the entire nonattainment area for the years 2005, 2010 and 2020.

Table 5.1 - Emission Estimates for On-Road Mobile Sources

	2005	**2010**	**2020**
VMT (miles/day)	8,402,660	8,739,730	9,973,260
Direct $PM_{2.5}$ (tons/year)	152.88	77.15	54.61
NO_x (tons/year)	8,114.37	4,212.01	2,092.15

5.5 Motor Vehicle Emission Budget

Table 5.2 contains the motor vehicle emissions budgets (Budgets) for the entire nonattainment area for the years 2010 and 2020.

Table 5.2 – Motor Vehicle Emission Budgets in Tons per Year

Year	2010	2020
$PM_{2.5}$	81.01	60.07
NO_x	4,422.61	2,301.37

Consistent with the federal implementation rule for fine particles, Indiana does not consider mobile source sulfur dioxide (SO_2) to be a significant contributor to fine particles for this nonattainment area, as SO_2 constitutes less than one percent (<1%) of the area's total anthropogenic emissions.

These Budgets include the emissions estimates calculated for 2010 and 2020. The emission estimates are derived from the EMPO travel demand model and MOBILE6.2 as described above. Through the interagency consultation process, it was determined that an interim Budget for the year 2010, in addition to the Budget for the year 2020, would be appropriate. A reasonable margin of safety has been applied to the 2010 and 2020 Budgets in the amount of 5% and 10% respectively. Margins of safety are used to accommodate the wide array of assumptions that are factored into the calculation process. Since assumptions change over time, it is necessary to have a margin of safety that will accommodate the impact of refined assumptions in the process. The resulting 2010 and 2020 Budgets for total direct $PM_{2.5}$ and NO_x emissions remain well below the 2005 base year emissions referenced in Table 5.1.

All methodologies, latest planning assumptions and margins of safety were determined appropriate through the interagency consultation process.

6.0 CONTROL MEASURES AND REGULATIONS

This section provides specific information on the control measures implemented in the Southwestern Indiana Area, including CAAA requirements and additional state or local measures implemented beyond CAAA requirements.

6.1 Reasonably Available Control Technology (RACT)

As required by Section 172 of the CAAA, Indiana in the mid-1990s promulgated rules requiring RACT for emissions of VOCs. There were no specific rules required by the CAAA such as RACT for existing sources beyond statewide rules for the Southwestern Indiana Area as defined in Sections 1.1 and 1.2. Statewide RACT rules have applied to all new sources locating in Indiana since that time. The Indiana rules are found in 326 IAC 8. The following is a listing of applicable rules:

326 IAC 8-1-6	BACT for non-specific sources
326 IAC 8-2	Surface Coating Emission Limitations
326 IAC 8-3	Solvent Degreasing Operations

326 IAC 8-4	Petroleum Sources
326 IAC 8-5	Miscellaneous Operation
326 IAC 8-6	Organic Solvent Emission Limitations

Since the Southwestern Indiana Area attained the annual standard for fine particles prior to an Attainment SIP or RACT SIP being due, and since the implementation rule for fine particles stipulates that states are only required to draft and implement RACT rules for the precursor emission reductions necessary to attain the standard, no further RACT rules are required for this area.

6.2 Implementation of Past SIP Revisions

The area was only recently designated nonattainment for the annual standard for fine particles and the area has now attained the standard well in advance of its attainment deadline of 2010. As a result, Indiana is no longer required to develop and submit an Attainment SIP or RACT SIP for this area under the annual NAAQS for fine particles.

6.3 Nitrogen Oxides (NO_x) Rule

The U.S. EPA NO_x SIP Call required twenty-two states to adopt rules that would result in significant emission reductions from large EGUs, industrial boilers, and cement kilns in the eastern United States. Indiana adopted this rule in 2001. Beginning in 2004, this rule accounts for a reduction of approximately thirty-one percent (31%) of all NO_x emissions statewide compared to previous uncontrolled years.

Twenty-one other states have also adopted these rules. The result is that significant reductions have occurred upwind and within the Southwestern Indiana Nonattainment Area because of the number of affected units within the region. From Graphs 4.7 and 4.9 it can be seen that emissions covered by this program have been trending downward since 1999. Table 6.1, compiled from data taken from the U.S. EPA Clean Air Markets Web site, quantifies the gradual NO_x reductions that have occurred in Indiana as a result of Title IV (Acid Rain) of the Clean Air Act Amendments and the NO_x SIP Call Rule. This cap will stay in place through 2008, at which time the caps in the CAIR program will supersede it.

Further, U.S. EPA has recently published Phase II of the NO_x SIP Call that establishes a budget for large (emissions of greater than 1 ton per day) stationary internal combustion engines. This rule will decrease emissions statewide from natural gas compressor stations by 4,263 tons during the ozone season. This rule became effective February 26, 2006. Implementation of this rule began in 2007.

Table 6.1
Trends in EGU NO_x Emissions Statewide in Indiana

Year	NO_x Emissions (tons /year)
1999	347,217
2000	334,522

2001	315,420
2002	281,146
2003	260,980
2004	224,311
2005	207,982
2006	202,728
Budget 2009-2014	108,935
Budget 2015 and later	90,779

6.4 Measures Beyond Clean Air Act SIP Requirements

Reductions in fine particle precursor emissions have occurred, or are anticipated to occur, as a result of local and federal programs. These additional control measures include:

Tier II Vehicles Standards[6]

Federal Tier II vehicle standards will require all passenger vehicles in a manufacturer's fleet, including light-duty trucks and sport utility vehicles (SUVs), to meet an average standard of 0.07 grams of NO_x per mile. Implementation began in 2004, and should be completely phased in by 2007. The Tier II standards also cover passenger vehicles over 8,500 pounds gross vehicle weight rating (the larger pickup trucks and SUVs), which are not covered by the current Tier I regulations. For these vehicles, the standards will be phased in beginning in 2008, with full compliance in 2009. The new standards require vehicles to be 77% to 95% cleaner than those on the road today. The Tier II standards also reduce the sulfur content of gasoline to 30 ppm starting in January 2006. Most gasoline sold in Indiana prior to January 2006 had a sulfur content of about 500 ppm. Sulfur occurs naturally in gasoline, but interferes with the operation of catalytic converters on vehicles resulting in higher NO_x emissions. Lower sulfur gasoline is necessary to achieve the Tier II vehicle emission standards.

Heavy-Duty Gasoline and Diesel Highway Vehicle Standards[7]

New U.S. EPA standards designed to reduce NO_x and VOC emissions from heavy-duty gasoline and diesel highway vehicles began to take effect in 2004. A second phase of standards and testing procedures, beginning in 2007, will reduce fine particle emissions from heavy-duty highway engines, and will also reduce highway diesel fuel sulfur content to 15 ppm since the sulfur can damage emission control devices. The total program is expected to achieve a 90% reduction in direct particulate matter emissions and a 95% reduction in NO_x emissions for these new engines using low sulfur diesel, compared to existing engines using higher-content sulfur diesel.

Large Nonroad Diesel Engine Standards[8]

6 http://www.epa.gov/fedrgstr/EPA-AIR/2000/February/Day-10/a19a.htm
7 http://www.epa.gov/fedrgstr/EPA-AIR/1997/October/Day-21/a27494.htm
8 http://www.epa.gov/fedrgstr/EPA-AIR/1998/October/Day-23/a24836.htm

In May 2004, U.S. EPA promulgated new rules for large non-road diesel engines, such as those used in construction, agricultural and industrial equipment, to be phased in between 2008 and 2014. The non-road diesel rules also reduce the allowable sulfur in non-road diesel fuel by over 99%. Non-road diesel fuel currently averages approximately 3,400 ppm sulfur. This rule limited non-road diesel sulfur content to 500 ppm in 2006 and 15 ppm in 2010. The combined engine and fuel rules would reduce NO_x and PM emissions from large non-road diesel engines by over 90%, compared to current non-road engines using higher-content sulfur diesel.

Nonroad Spark-Ignition Engines and Recreational Engines Standards

The new standard, effective in July 2003, regulates NO_x, VOCs and carbon monoxide (CO), for groups of previously unregulated non-road engines. The new standard applies to all new engines sold in the United States and imported after the standards went into effect. The standard applies to large spark-ignition engines (forklifts and airport ground service equipment), recreational vehicles (off-highway motorcycles and all-terrain vehicles), and recreational marine diesel engines. The regulation varies based upon the type of engine and vehicle.

The large spark-ignition engines contribute to ozone formation and ambient CO and PM levels in urban areas. Tier I of this standard was implemented in 2004 and Tier II is scheduled to start in 2007. Like the large spark-ignition engines, recreational vehicles contribute to ozone formation and ambient CO and PM levels. For the off-highway motorcycles and all-terrain vehicles, model year 2006, the new exhaust emission standard was phased-in by 50% and for model year 2007 and later, at 100%. Recreational marine diesel engines over 37 kilowatts are used in yachts, cruisers, and other types of pleasure crafts. Recreational marine engines contribute to ozone formation and PM levels, especially surrounding marinas. Depending on the size of the engine, the standard began phasing-in in 2006.

When all of the non-road spark-ignition engines and recreational engine standards are fully implemented, an overall 72% reduction in VOCs, 80% reduction in NO_x and 56% reduction in CO emissions are expected by 2020. These controls will help reduce ambient concentrations of ozone, CO and fine PM.

Clean Air Interstate Rule (CAIR)

On May 12, 2005, the U.S. EPA promulgated the "Rule to Reduce Interstate Transport of Fine Particulate Matter and Ozone (Clean Air Interstate Rule); Revisions to Acid Rain Program; Revisions to the NO_x SIP Call", referred to as CAIR. This rule established the requirement for States to adopt rules limiting the emission of NO_x and sulfur dioxide (SO_2) and a model rule for the states to use in developing their rules. The purpose of CAIR is to reduce interstate transport of precursors to fine particles and ozone.

CAIR applies to (1) any stationary, fossil-fuel-fired boiler or stationary, fossil-fuel-fired combustion turbines, a generator with nameplate capacity of more than 25 MWh producing electricity for sale and (2) for a unit that qualifies as a cogeneration unit during the 12-month period starting on the date that the unit first produces electricity and continues to qualify as a cogeneration unit, a cogeneration unit serving at any time a generator with a nameplate capacity of more than 25 MWh and supplying in any calendar year more than one-third of the unit's potential electric output capacity or 219,000 MWh, whichever is greater to any utility power distribution system for sale.

This rule provides annual State caps for NO_x and SO_2 in two phases, with the Phase I caps for NO_x and SO_2 starting in 2009 and 2010, respectively. Phase II caps become effective in 2015. The U.S. EPA is allowing the caps to be met through a cap and trade program if a state chooses to participate it the program.

In response to U.S. EPA's rulemaking, IDEM adopted its state rule in 2006 based on the federal rule. IDEM's rule includes an annual and seasonal NO_x trading program, and an annual SO_2 trading program. This rule requires compliance beginning in 2009.

Together, these rules will substantially reduce local and regional sources of fine particle precursors. The modeling analyses discussed in Section 7.0 include these rules and show the reductions in annual fine particle concentrations expected to result from the implementation of these rules.

6.5 Controls to Remain in Effect

Indiana commits to maintain the control measures listed above after redesignation, or submit to U.S. EPA as a SIP revision any changes to its rules or emission limits applicable to SO_2 or NO_x sources as required for maintenance of the fine particles standard in the Southwestern Indiana Area.

Indiana, through IDEM's Office of Air Quality and its Office of Enforcement, has the legal authority and necessary resources to actively enforce any violations of its rules or permit provisions. After redesignation, it intends to continue enforcing all rules that relate to the emission of fine particles and fine particle precursors in the Southwestern Indiana Area.

6.6 New Source Review Provisions

Indiana has a long standing and fully implemented New Source Review (NSR) program that is outlined in rule 326 IAC 2. The rule includes provisions for the Prevention of Significant Deterioration (PSD) permitting program in 326 IAC 2-2. Indiana's PSD program was conditionally approved on March 3, 2003 (68 FR 9892) and received final approval on May 20, 2004 (69 FR 29071) by U.S. EPA as part of the SIP.

Any facility that is not listed in the 2002 emission inventory, or for emission reductions which credit through closing was taken in demonstrating attainment, will not be allowed to construct, reopen, modify, or reconstruct without meeting all applicable permit rule requirements. The review process will be identical to that used for new sources. Once the area is redesignated, OAQ will implement NSR through the PSD program, which requires an air quality analysis to evaluate whether the new source will threaten the NAAQS.

7.0 MODELING AND METEOROLOGY

Although U.S. EPA's redesignation guidance does not require modeling for fine particle nonattainment areas seeking redesignation, extensive modeling has been performed covering the Southwestern Indiana region to determine the effect of national emission control strategies on fine particle levels. These modeling analyses determined that Southwestern Indiana including Vanderburgh, Warrick, Dubois Counties and Montgomery Township in Gibson County, Ohio Township in Spencer County and Washington Township in Pike County are significantly impacted by regional transport of particulate matter and its precursors, and regional SO_2 and NO_x reductions are an effective way to attain the annual fine particles standard in this area. Future year modeled annual fine particle concentrations are expected to be reduced by 8% to 24% from baseline design values. Examples of these modeling analyses are listed below.

7.1 Summary of Modeling Results to Support Rulemakings

U.S . Modeling for Clean Air Interstate Rule (CAIR), 2005

On March 10, 2005, the U.S. EPA finalized the Clean Air Interstate Rule (CAIR). SO_2 emissions from power plants in the 28 eastern states and the District of Columbia covered by CAIR, will be cut by 4.3 million tons by 2009 and reduced by an additional 5.4 million tons in 2015 with NO_x emissions cut by 1.7 million tons by 2009 and reduced by an additional 1.3 million tons in 2015. Indiana will reduce SO_2 emissions from the implementation of CAIR in 2009 by 222,000 tons in the 2009 emissions projections without CAIR and by 2015, will be reduced by an additional 178,000 tons from the 2015 emissions projections without CAIR. Indiana will reduce NO_x emissions from the implementation of CAIR in 2009 by 113,000 tons from the 2009 emissions projections without CAIR and by 2015, will be reduced by one 149,000 tons from the 2015 emissions projections without CAIR.

U.S. EPA performed modeling to support the emission reductions associated with CAIR. U.S. EPA used the Community Multiscale Air Quality Model (CMAQ) applied to the year 2001 meteorology, as processed by Mesoscale Model (MM5). Emissions input into CMAQ included sulfur dioxide, nitrogen oxides, volatile organic compounds, ammonia and direct $PM_{2.5}$ for 2001. The modeling was based on the annual fine particulate design values calculated from 1999 through 2003. Future year modeling was conducted, including the Southwestern Indiana counties, and the future year design values for 2010

and 2015 were evaluated for attainment of the annual fine particles NAAQS of 15 µg/m^3, as shown below in Table 7.1. Daviess County in Kentucky is considered an upwind county from the Southwestern Indiana Area and will be reviewed along with the Southwestern Indiana fine particulate nonattainment areas. Modeled results for Daviess County have been included in the modeling analysis. Fine particle concentrations are accounted for through CAIR by modeling both the base future year emissions and then the emissions reductions associated with CAIR. U.S. EPA found model performance met suggested benchmark performance goals and within the range or better than other comparable modeling applications.

Table 7.1 Modeling Results from U.S. EPA for the Clean Air Interstate Rule

County	MSA/CMSA	Design Value 1999-2003	Future Design Value 2010 Base	Future Design Value 2010 with CAIR	Future Design Value 2015 without CAIR	Future Design Value 2015 with CAIR
		(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)
Vanderburgh	Evansville, IN	15.60	15.54	14.26	15.56	14.17
Spencer		14.43	13.96	12.63	13.84	12.28
Knox		13.83	13.55	12.1	13.37	11.83
Dubois		16.02	15.73	14.37	15.66	14.16
Daviess Co., KY	Owensboro, KY	14.94	14.15	12.88	14.05	12.65

Modeling results showed that the base future year modeling without CAIR accounts for approximately 0.1 to 0.5 µg/m^3 decreases in concentrations for 2010 and approximately 0.04 to 0.6 µg/m^3 decreases in concentrations for 2015. The future year modeling showed that emissions reductions associated with CAIR would account for approximately 1.3 to 1.8 µg/m^3 decreases in concentrations for 2010 and approximately 1.4 to 2.0 µg/m^3 decreases in concentrations for 2015. Therefore, impacts from CAIR equate to approximate decreases of 1.0 to 1.3 µg/m^3 by 2010 and 1.3 to 1.4 µg/m^3 by 2015.

Results of the U.S. EPA CAIR modeling show that all Southwestern Indiana counties will attain the annual fine particles NAAQS in 2010 with modeled impacts reduced by 8 % to 14%, and remain below 15 µg/m^3. With further reductions projected in CAIR for 2015, all design values decrease by 9% to 15% and continue to attain the fine particles NAAQS.

LADCO Modeling for Clean Air Interstate Rule (CAIR)

The Lake Michigan Air Directors Consortium (LADCO) conducted modeling to determine the impact of CAIR in the Midwest. LADCO's modeling used the

Comprehensive Air Quality Model with extensions (CAMx) applied to the year 2005 meteorology, as processed by Mesoscale Model (MM5). Emissions input into CAMx included sulfur dioxide, nitrogen oxides, volatile organic compounds, ammonia and direct $PM_{2.5}$ for 2005. The modeling was based on 2003 through 2006 design values. Future year modeling for 2009, 2012, and 2018 was conducted and the future year design values were determined, as shown below in Table 7.2.

Table 7.2 LADCO's Round 5 Modeling Results for the Clean Air Interstate Rule

Monitor ID	Monitor Name	County	Design Value 2003-2006	Basecase with CAIR - 2009	Basecase with CAIR - 2012	Basecase with CAIR – 2018
			($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
181630006	Civic Center	Vanderburgh	14.8	12.5	12.4	11.9
181630012	W. Mill Rd.	Vanderburgh	14.9	12.4	12.3	11.8
181630016	Univ. of Evansville	Vanderburgh	15.1	12.8	12.7	12.2
181470009	Dale	Spencer	14.4	11.7	11.6	11.2
180372001	Jasper Post Office	Dubois	15.3	12.4	12.3	11.7
1803700041	Sports Complex	Dubois	13.6	11.1	11.1	10.6
1803700051	Jasper Golf Course	Dubois	13.7	11.2	11.2	10.7
180830004	SW Purdue Ag.	Knox	14.1	11.6	11.5	11.1
210590005	Owensboro	Daviess - KY	14.4	12.1	12.0	11.6
210590014	Wesleyan College	Daviess - KY	13.0	11.0	11.0	10.6

Results of the LADCO CAIR modeling show that all Southwestern Indiana Counties will attain the annual NAAQS for fine particles of $15\mu g/m^3$ by 2009. Future year modeled fine particle concentrations for 2009 will be 15% to 19% lower than baseline fine particles design values, 16% to 20% lower in 2012 and 19% to 24% lower in 2018. Fine particle concentrations are predicted to continue to decrease and remain in attainment of the annual fine particles NAAQS of $15\mu g/m^3$.

SMAT Results taken from LADCO's Round 4 Modeling for CAIR

Speciated Modeled Attainment Test (SMAT) is the attainment test for annual fine particles. In determining the future year annual fine particle concentrations, speciated data is calculated. The different species that were modeled and are associated with fine particles include sulfates, nitrates, ammonium, organic carbon, elemental carbon, particle bound water, "other" primary inorganic fine particles and passively collected mass. SMAT results from LADCO's Round 4 modeling are listed below. Percent ranges of the model results from the four fine particle monitors in Southwestern Indiana were broken down into these speciated constituents of fine particles. The percent change from the observed speciated data to the future year modeled results are listed in Table 7.3.

Table 7.3 LADCO's Round 4 PSAT/SMAT Modeling Results in Percent Reduction

	2009	**2012**	**2018**
Sulfates	20% - 22%	24% - 26%	26% - 29%

Nitrates	0% - 9%	0% - 9%	9% - 18%
Organic Carbon	2% - 3%	2% - 4%	2% - 5%
Elemental Carbon	0% - 20%	20%	20%
Ammonium	18% - 19%	18% - 25%	24% - 29%
Particle Bound Water	15% - 23%	23%	23% - 31%

The results show that sulfate, elemental carbon and ammonium reductions are projected to occur by at least 20% in the future year. Lesser nitrate reductions are projected to occur by 9% to 18% with organic carbon reductions occurring from 2% to 5%. It should be noted that the model performance for LADCO's Round 4 annual fine particles modeling does not meet U.S. EPA model performance criteria at this time. LADCO modeling performance shows good performance for sulfates and elemental carbon predicted concentrations, over-prediction for nitrate concentrations and under-predictions of organic carbon concentrations. Overall, model performance is not adequate for State Implementation Plan (SIP) planning but gives a good idea of the effects of emissions reductions from national emission control measures. Preliminary results for revised modeling show that fine particles model performance is improving and future modeling will more accurately predict fine particle concentrations.

7.2 Summary of Existing Modeling Results

U.S. EPA and LADCO modeling for future year design values have consistently shown that existing national emission control measures will bring the Southwestern Indiana counties into attainment of the annual NAAQS for fine particles. Emission control measures to be implemented in the next several years will provide even greater assurance that air quality will continue to meet the standard into the future. Modeling support for the Clean Air Interstate Rule has shown that future year design values for the Southwestern Indiana counties will continue to attain the annual standard for fine particles with modeled future year design values below 15 $\mu g/m^3$. U.S. EPA future year modeling of national emission control strategies showed the Southwestern Indiana counties will attain the annual NAAQS for fine particles without additional national emission controls. Future national and local emission control strategies will ensure that each Southwestern Indiana county's fine particles attainment area will be maintained with an increasing margin of safety over time.

7.3 Meteorological Analysis for Southwest Indiana

Meteorological conditions are one of the most important factors that influence development and transport of fine particles. Stagnant surface conditions during any time of the year and upper air ridging provides conducive conditions for development and transport of fine particles. Ultimately, passage of surface cold fronts with a clean air mass change will lower fine particle readings in the Southwestern Indiana Area.

7.4 Surface Air Conditions Present during High Fine Particle Concentrations Days

Higher annual concentrations of fine particles tend to correlate with warmer temperatures and lighter wind speeds, although high fine particle episodes can occur in the summer or winter. It should be noted that higher annual fine particle concentrations are driven by individual days with higher fine particle concentrations throughout the monitored year. Therefore, it is difficult to attribute higher fine particle concentrations to annualized meteorological rankings. Review of several of the higher fine particle concentration episodes over the past few years shows conditions were hot in the summer with temperatures in the middle 80os F or higher and average wind speeds were fairly light. Fall and winter days with higher fine particle concentrations had near normal temperatures but wind speeds were very light.

7.5 Upper Air Conditions Present during High Fine Particle Concentrations Days

Upper air ridges and more stagnant surface wind conditions predominately affect development and build up of fine particles. Slow moving upper air ridges can effectively suppress mixing within the many levels of the atmosphere and cause pollutants to build up over time. Inversions or increases in temperature with a rise in altitude will prevent mixing with air from the upper atmosphere. These conditions can occur at any time of the year and are evident in elevated fine particle episodes in spring, summer, fall and winter months. Review of surface and upper air features of higher fine particle concentration days showed stagnant surface conditions and upper air ridges existed on those days and helped in the buildup of fine particle concentrations.

7.6 Analyses of Atmospheric Conditions during High Fine Particle Concentration Days

Analyses have been conducted to determine the atmospheric conditions that are most prevalent during higher fine particle concentration days in Indiana. LADCO applied a Classification and Regression Tree (CART) analysis to data from Indiana that correlated different levels of fine particle concentrations to meteorological conditions from 1999 – 2004. (Donna Kenski, 2005). This type of analysis looks at the meteorological conditions, such as temperature, pressure, wind speed, wind direction, relative humidity and dewpoint temperatures at the surface as well as morning and evening mixing heights in the upper atmosphere which were present when higher concentrations of fine particles were monitored. Results of this CART analysis indicated factors that played a larger role in higher fine particle concentrations in Indiana were warm-weather conditions with high dew points, southwest winds and high evening mixing heights. Previous day's concentrations of fine particles play a key role in higher impacts as well.

Fine particles are made up of several constituents, including direct PM2.5, sulfates, nitrates, ammonium, organic carbon and elemental carbon. Depending on the time of the year, concentrations of particulate constituents vary, with nitrates being more prevalent in the winter and sulfates more prevalent in the summer. Emission reductions of sulfates and nitrates appear to have the biggest impact on lower future year fine particle concentrations.

Table 7.4 shows by year, the highest number of days during which particulate levels reached the Air Quality Index ranges for "Good" (0 to15 µg/m^3), "Moderate" (15.4 µg/m^3 to 40.4 µg/m^3) and "Unhealthy for Sensitive Groups"(40.5 µg/m^3 to 65.4 µg/m^3). There were no days during which particulate levels reached the "Unhealthy" level of 65.5 µg/m^3 to150.4 µg/m^3.

Table 7.4 Ranking of Highest Number of Days at AQI Levels of Health Concerns

Ranking	Good	Moderate	Unhealthy for Sensitive Group
1st	2004	2005	2005
2nd	2006	2001	2001/2002/2003
3rd	2003	2002	2006
4th	2002	2003/2006	2004
5th	2001	2004	
6th	2005		

Based on the rankings for the AQI Levels of Health Concerns, 2005 had the most monitored days in Southwest Indiana with fine particle readings in the moderate and USG levels and the lowest number of days in the Good level.

7.7 Summary of Meteorological Analysis for Southwest Indiana

Annual fine particle concentrations in the Southwestern Indiana Area are driven by higher fine particle concentration days that can occur during any time of the year. Conditions that are most prevalent during higher fine particle concentration days are lighter winds, higher relative humidity and above average temperatures in the summer and near normal temperatures in the fall, winter or spring. Upper air weather patterns generally include ridging over the area with stagnant conditions at the surface. Surface winds from any direction can transport pollutants from surrounding areas into the Southwestern Indiana Area. Nitrates are bigger contributors to fine particle concentrations in the winter and sulfates are bigger contributors to fine particle concentrations in the summer.

8.0 CORRECTIVE ACTIONS

8.1 Commitment to Revise Plan

As noted in Section 4.6 above, Indiana hereby commits to review and revise as appropriate its Maintenance Plan eight years after redesignation, as required by Section 175A of the CAAA.

8.2 Commitment for Contingency Measures

Indiana will monitor fine particle concentrations to determine whether trends indicate higher values or whether emissions appear to be increasing. If it is determined that fine particle levels and emissions are increasing and action is necessary to reverse that trend, Indiana will take action to reverse the noted trend, prior to a violation of the standard occurring.

Indiana hereby commits to adopt and expeditiously implement necessary corrective action in the following circumstance:

Action Level Response

An Action Level Response shall be prompted whenever a violation of the standard (three (3)-year average annual arithmetic mean value of 15.1 $\mu g/m^3$ or greater) occurs. In the event that the Action Level is triggered and is not found to be due to an atypical unfavorable meteorological condition, exceptional event, malfunction, or noncompliance with a permit condition or rule requirement, IDEM will determine additional control measures needed to assure future attainment of NAAQS for fine particles. In this case, measures that can be implemented in a short time will be selected in order to be in place within eighteen (18) months from the close of the fine particles season that prompted the Action Level.

Control Measure Selection and Implementation

Adoption of any additional control measures is subject to the necessary administrative and legal process. This process will include publication of notices, an opportunity for public hearing, and other measures required by Indiana law for rulemaking by state environmental boards.

If a new measure or control is already promulgated and scheduled to be implemented at the federal or state level, and that measure or control is determined to be sufficient to address the upward trend in air quality, additional local measures may be unnecessary. Furthermore, Indiana will submit to U.S. EPA an analysis to demonstrate the proposed measures are adequate to return the area to attainment.

8.3 Contingency Measures

Contingency measures to be considered will be selected from a comprehensive list of measures deemed appropriate and effective at the time the selection is made. Listed below are example measures that may be considered. The selection of measures will be based upon cost-effectiveness, emission reduction potential, economic and social considerations or other factors that IDEM deems appropriate. IDEM will solicit input from all interested and affected persons in the maintenance area prior to selecting appropriate contingency measures. All of the listed contingency measures are potentially effective or proven methods of obtaining significant reductions of fine particle precursor emissions. Because it is not possible at this time to determine what control measure will

be appropriate at an unspecified time in the future, the list of contingency measures outlined below is not comprehensive. Indiana anticipates that if contingency measures should ever be necessary, it is unlikely that a significant number (i.e., all those listed below) will be required.

1) Alternative fuel and diesel retrofit programs for fleet vehicle operations.
2) Require NO_x or SO_2 controls on new minor sources (less than 100 tons).
3) Wood stove change out program.
4) Idle restrictions.
5) Broader geographic applicability of existing measures.
6) One or more transportation control measures sufficient to achieve at least a half a percent (0.5%) reduction in actual area wide precursor emissions. Transportation measures will be selected from the following, based upon the factors listed above, after consultation with affected local governments:
    a. Trip reduction programs, including, but not limited to, employer-based transportation management plans, area-wide rideshare programs, work schedule changes, and telecommuting.
    b. Transit improvements.
    c. Traffic flow improvements.
    d. Other new or innovative transportation measures not yet in widespread use that affects state and local governments deemed appropriate.

No contingency measure shall be implemented without providing the opportunity for full public participation during which the relative costs and benefits of individual measures, at the time they are under consideration, can be fully evaluated.

9.0 PUBLIC PARTICIPATION

This section to be completed at the conclusion of the public hearing process.

10.0 CONCLUSIONS

The Southwestern Indiana Area has attained the annual NAAQS for fine particles. This petition demonstrates that the Southwestern Indiana Area has complied with the applicable provisions of the 1990 Amendments to the Clean Air Act regarding redesignation of nonattainment areas for fine particles. IDEM has prepared a State Implementation and Maintenance Plan that meets the requirement of Section 110 (a)(1) of the 1990 Clean Air Act.

Indiana has performed an analysis that shows the air quality improvements are due to permanent and enforceable measures and that additional significant regional NO_x reductions following implementation of Phase II NO_x SIP Call and CAIR will ensure

continued compliance (maintenance) with the standard. Furthermore, because this area is subject to significant transport of pollutants, significant regional SO_2 and NO_x reductions will ensure continued compliance (maintenance) with the standard with an increasing margin of safety. Based on this presentation, the Southwestern Indiana Area Nonattainment Area for fine particles meets the requirements for redesignation under the CAA (Section 107 (d) (3)) and U.S. EPA guidance.

Consistent with the authority granted to the U.S. EPA, the State of Indiana hereby requests that the Southwestern Indiana Area Nonattainment Area for fine particles be redesignated to attainment simultaneously with U.S. EPA approval of the Indiana State Implementation and Maintenance Plan provisions contained herein.